



Combined Heat & Power: Status and Prospects

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United States

December 10-12th, 2008
Nice • France



GDF SUEZ



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Combined Heat and Power

- Combined heat and power (CHP) systems, also known as cogeneration, simply capture and utilize excess heat generated during the production of electric power
- CHP systems offer economic, environmental and reliability-related advantages compared to power generation facilities that produce only electricity
- Distributed power generation systems, which are frequently located near thermal loads, are particularly well suited for CHP applications



CHP in California Today

- Highest capacity in the U.S. – 9,119 MW located at 782 sites
- CHP Applications
 - Enhanced Oil Recovery - 31%
 - Commercial/Institutional - 18%
 - Food Processing - 15%
 - Refining - 13%
 - Metals - 5%
 - Paper - 5%
 - Chemicals – 5%
 - Other Industrial – 5%
- 17% < 5 MW
- 31% 5MW -50 MW
- 52% > 50 MW



7.5 MW CHP , Twenty-nine Palms, CA



California CHP Potential

- As of 2005, total remaining technical potential in California through 2020 for all types of CHP/CCHP in commercial, industrial, and multifamily residences is **30,000 MW**
 - **14,381 MW** – existing facilities
 - **5,793 MW** – new facilities
 - **4,123 MW** for on site **Combined Cooling and Heating**
 - **5,935 MW** excess for export to the grid



CHP Systems Are Efficient

- Generation systems producing only electric power will have an electric efficiency in the range of 20 - 55%
- Adding heat recovery, which increases useful energy by utilizing the heat and power generated, results in much higher total fuel utilization. Efficiencies can range from 50 - 90%
- Better economics (reduced energy consumption, reduced energy costs) and reduced GHG emissions (avoided energy consumption to generate heat)



Industry & Policymakers – CHP Value

- Can provide benefits by using local and surplus resources (particular use of waste heat, biomass and geothermal)
- Can reduce investment in large infrastructure investments and bring private investment to generation.
- Potential reduction in distribution upgrades as CHP market share increases
- Can contribute to GHG emission reduction goals
- Can reduce congestion and T&D energy losses
- Has the ability to reduce system-peak demand
- Can save customers money



Key Question

It is clear CHP has potential value, especially on paper.

So why is development lagging in California and the USA?



Packaged Combined Cooling, Heating and Power System



Competitive Issues for Customers

- Customer value decisions – payback, risk, capital budget allocations, management focus
- Project size based upon customer need
- Natural gas and electricity prices (spark spread)
- Tradeoff between equipment cost & performance
- Incentive payments are currently not available to nonrenewable CHP/DG
- Typically CHP outside normal business expertise



Policy and Regulatory Barriers

- Lack of policies or targeted incentive programs for CHP to develop a robust market
- Investor-owned /regulated utilities lose revenue when customers develop CHP projects, but do not lose revenue when they support energy efficiency
- No agreement on definition of high efficiency “preferred” CHP
- Sizing CHP systems to operate efficiently often results in the generation of excess electricity that cannot be sold to the grid



Technical Challenges (cost and environmental performance)

- Below 5 MW, reciprocating engines are cost effective and most technically mature of all CHP technologies, but have difficulty meeting progressively stricter air quality standards in CA
- CHP systems require additional design and integration during installation, and systems need to be packaged to reduce cost and simplify operation
- CCHP is also an option in warmer climates like California where air conditioning and refrigeration demand is high, but chillers are expensive



Encouraging Beneficial CHP

- Portfolio Standards: set a target penetration level and adjust incentives or conduct bidding for payment until target is reached
- Develop feed-in tariffs that take into account the locational value of CHP
- Reduce capital costs (provide incentive payments, tax credits, R&D funding)
- Value environmental benefits (reduction of GHG emissions)
- Allow export of excess electricity to the grid at competitive prices



New Direction for California

All energy issues in California are now considered in the context of the **Global Warming Solutions Act** that:

- Establishes a GHG emission limit for 2020 at a level equivalent to the state's 1990 emissions
- California is on track to adopt a plan in Jan '09 for achieving emission reductions from significant GHG sources via regulations, market mechanisms, and other actions
- For electric sector, GHG reduction will be accomplished with a mix of mandates and Cap & Trade



Global Warming Solutions Act

- Once adopted, recommends California take steps to encourage the development of new CHP facilities, with a target of an additional 4,000 MW of installed CHP capacity by 2020
- This amount of CHP would be enough to displace approximately 30,000 GWh of demand from other power generation sources
- It is anticipated that GHG emissions from many CHP Systems will be regulated under the proposed GHG cap-and-trade program in the plan



Waste Heat & Carbon Emissions Reduction Act

- Applies to small CHP systems (up to 20 MW). Requires regulatory agencies develop:
 - Feed-in tariff for excess electricity
 - May require California IOUs to purchase specified amounts of excess electricity from CHP customers that comply with specified sizing, energy efficiency, and air pollution control requirements
 - Pay-as-you-save pilot program



Identifying Locational value of DG

- Recent California cost-benefit evaluation of incentive programs for DG, evaluated environmental, economic, and grid impacts
- Significant conclusions of grid impacts:
 - DG has untapped potential to provide locational value to utilities when sized and located accurately.
 - DG can defer distribution system upgrades in certain applications.
 - A different approach, rates, and incentive design may encourage deploying locationally beneficial DG.



California Energy Commission



Identifying Locational Benefits of DG





State Actions Still Needed

- Continue to develop and strengthen state policies that support clean CHP and encourage the development of facilities throughout the state
- Establish revenue neutral programs that enable high efficiency CHP to export power to utilities
- Provide transparent locational price information.
- Provide options to help CHP facilities reduce the risk of natural gas price swings
- Support RD&D to reduce installed system costs and to match thermal output to site loads